SENTINEL 2

Mission Performance Centre

Telespazio

A Finmeccanica/Thales Compa

DLR

esa

European Commission

SEN2COR

ACIX

CEOS-WGCV ATMOSPHERIC CORRECTION INTER-COMPARISON EXERCISE

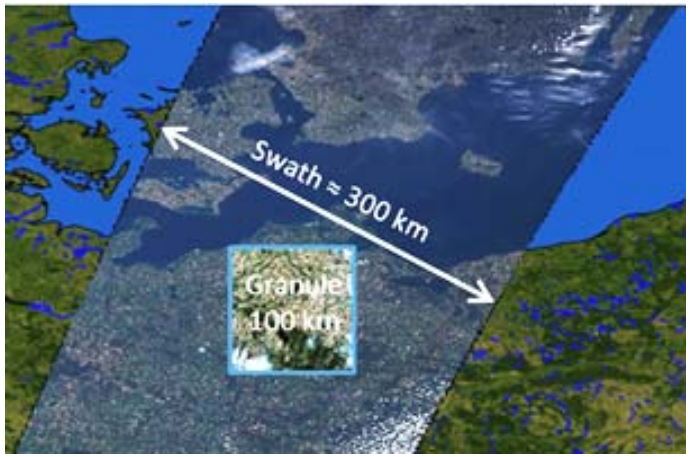
ADELPHI| MARYLAND| USA

21 JUNE 2016

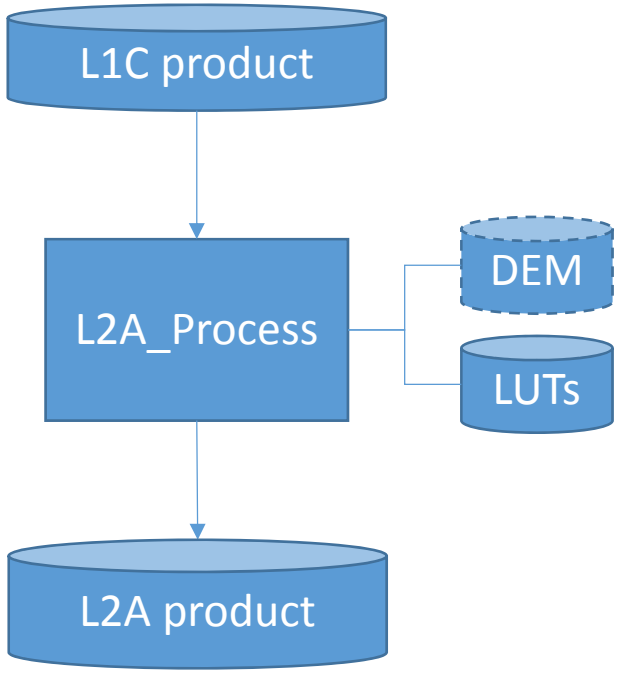
CS ACRI ST ARGANS elecnor deimos gmv AIRBUS DEFENCE & SPACE ThalesAlenia Space IGN ONERA Telespazio DLR

SEN2COR OVERVIEW

- Single-Mission tool for Sentinel-2 mission
- Atmospheric Correction over land surface
- Processing on orthorectified L1C granule for a single-time image
- Radiative Transfer code: LibRadtran.



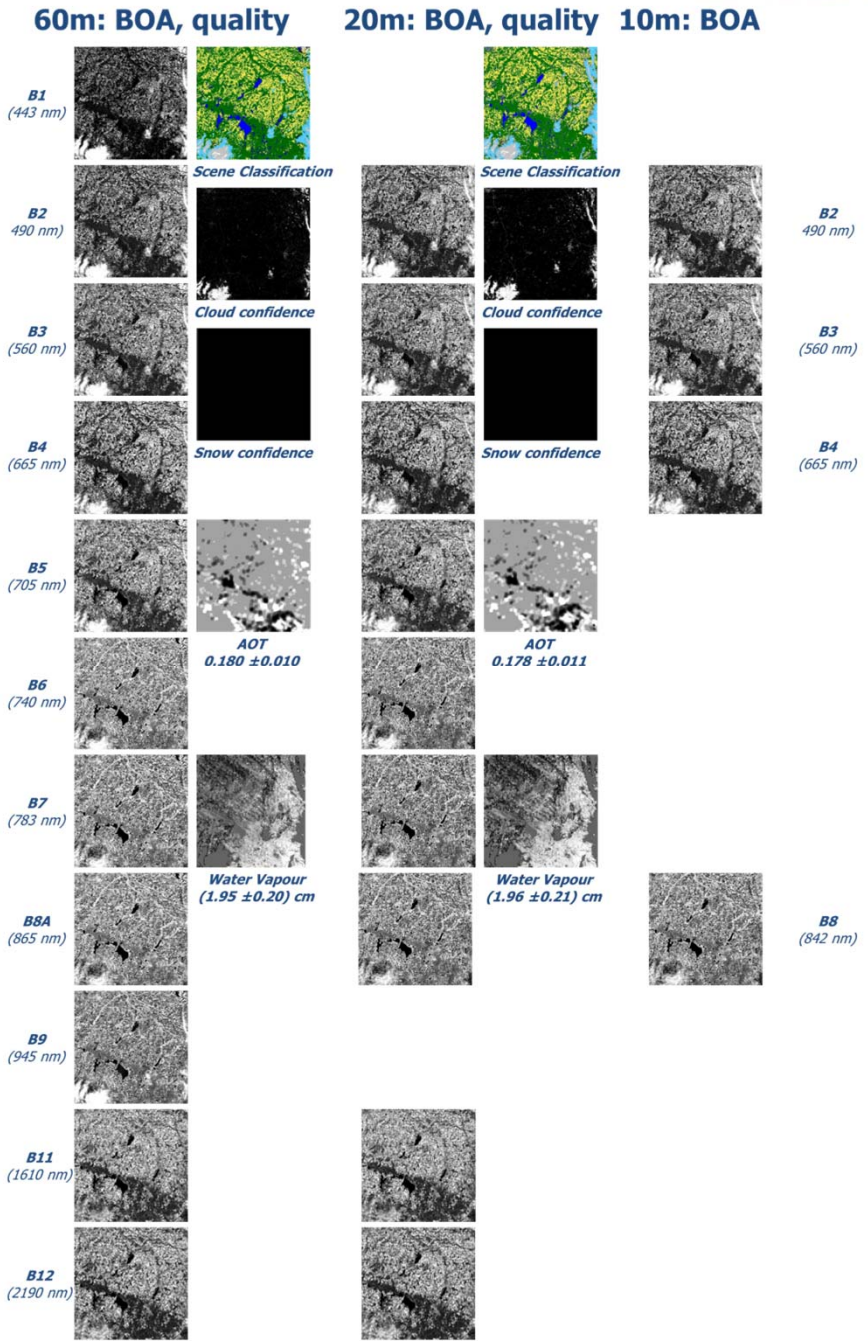
- Python application, Command line tool, also available from S2 toolbox
  - Requires: Anaconda, GDAL, OpenJPEG
- Processing configuration: XML-file



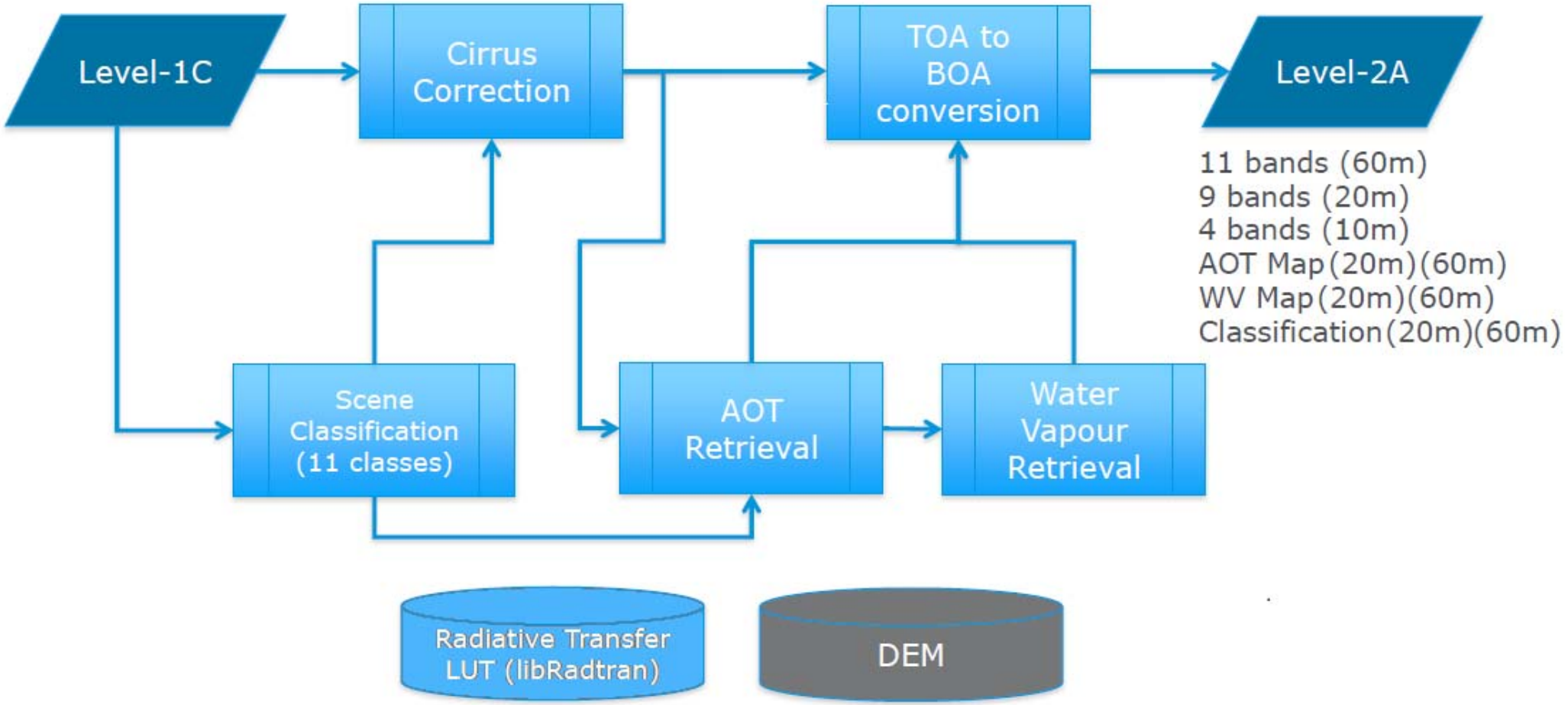
- Cloud Screening and Classification
- Cirrus removal option
- AOT estimation based on DDV-approach
- Water Vapour retrieval
- Terrain processing with empirical BRDF-correction
- Adjacency correction (post processing)

SEN2COR: INPUTS & OUTPUTS

- Input:
  - Level-1C ortho-image Top-Of-Atmosphere (TOA) reflectance products
    - ECMWF product TCO3
    - (AOT-field from ECMWF)
  - Look-up tables (rural & maritime aerosols)
  - DEM (default: SRTM v4 CGIAR) (or DTED provided by user)
- Output (60m, 20m, 10m):
  - Bottom-Of-Atmosphere (BOA) corrected reflectance
  - Aerosol Optical Thickness (AOT) map
  - Water Vapour (WV) map
  - Scene Classification (SC) map
  - Quality Indicators for cloud and snow probabilities



SEN2COR: MAIN PROCESSING STEPS



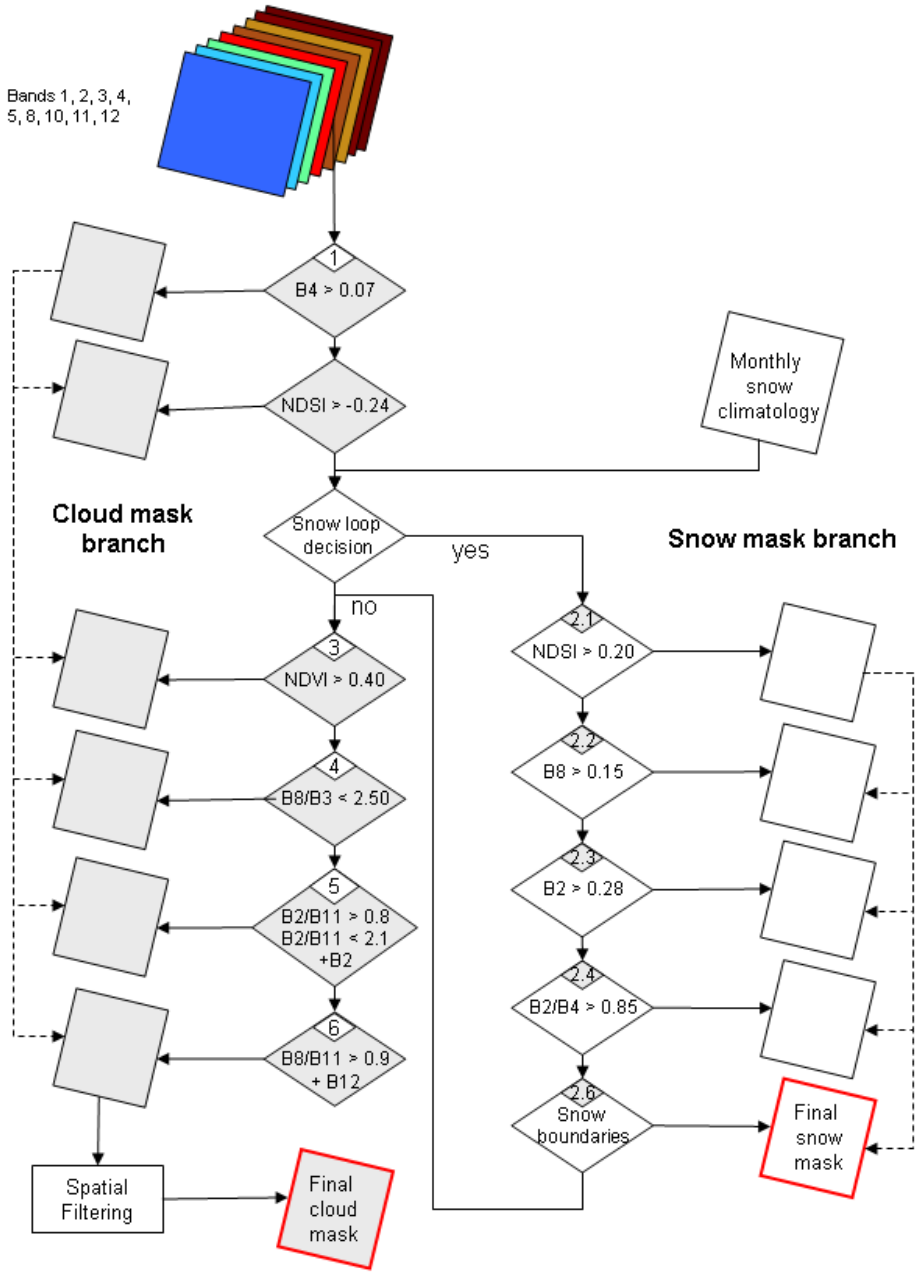
SEN2COR: CONFIGURATION

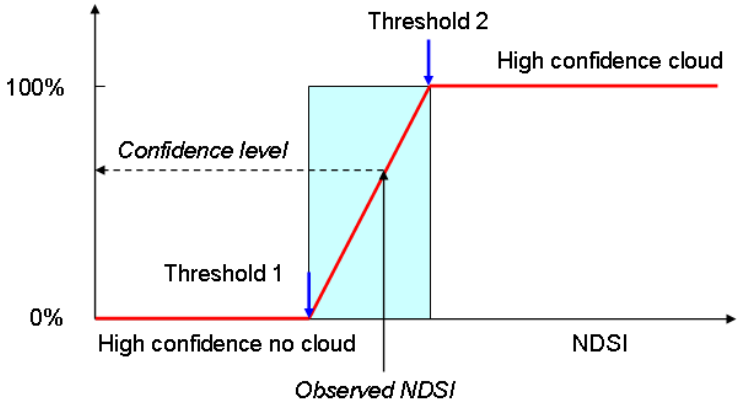
Ground Image Processing Parameter (GIPP):

- Common GIPPs
- Cloud Screening and scene Classification GIPPs
- Atmospheric correction GIPPs

Look-up-table selection	Default
Aerosol type	Rural (maritime, auto)
Atm. profile	Summer (summer, winter)
Ozone content	Use metadata (select value of LUT)

CLOUD SCREENING AND CLASSIFICATION OVERVIEW

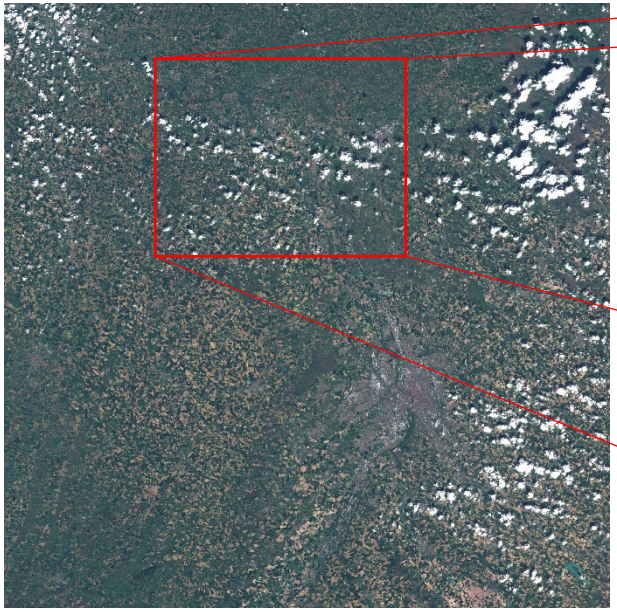




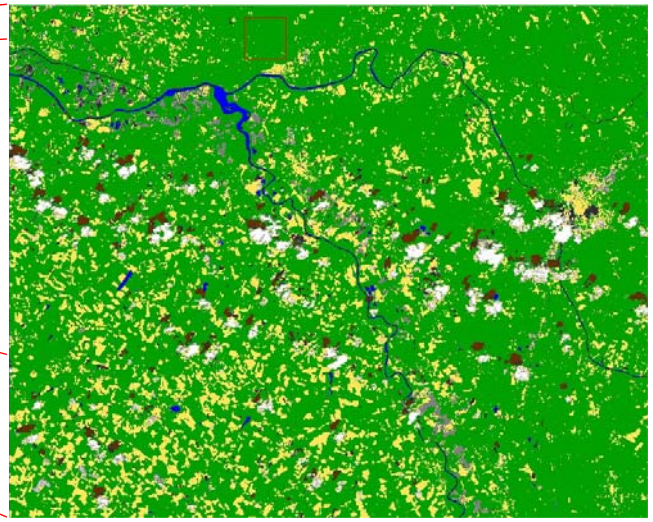
- Sequence of Threshold pairs
- Cloud Shadow Detection
- Topographic Shadows (DEM)
- Cirrus detection mitigation (DEM)

Cloud Screening and Classification Outputs

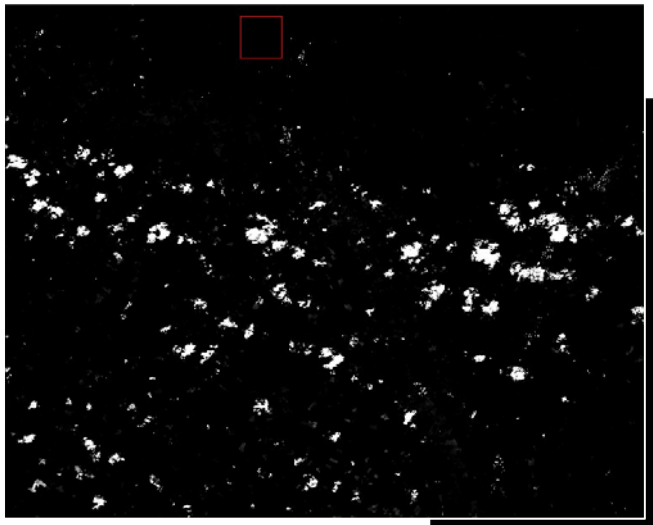
L1C Tile 31TCJ



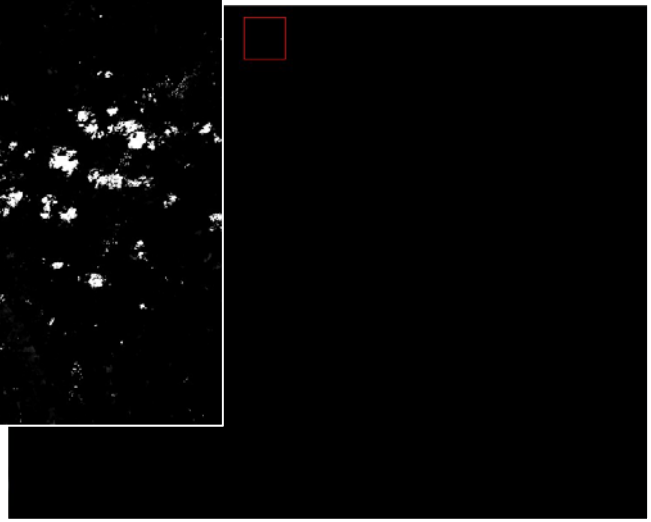
Scene Classification



0	No Data (Missing data on projected tiles) (black)
1	Saturated or defective pixel (red)
2	Dark features / Shadows (very dark grey)
3	Cloud shadows (dark brown)
4	Vegetation (green)
5	Bare soils / deserts (dark yellow)
6	Water (dark and bright) (blue)
7	Cloud low probability (dark grey)
8	Cloud medium probability (grey)
9	Cloud high probability (white)
10	Thin cirrus (very bright blue)
11	Snow or ice (very bright pink)



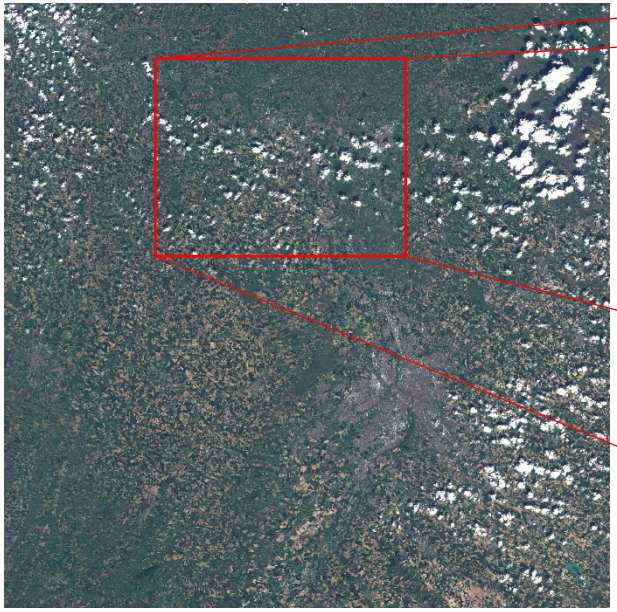
Snow Confidence QI



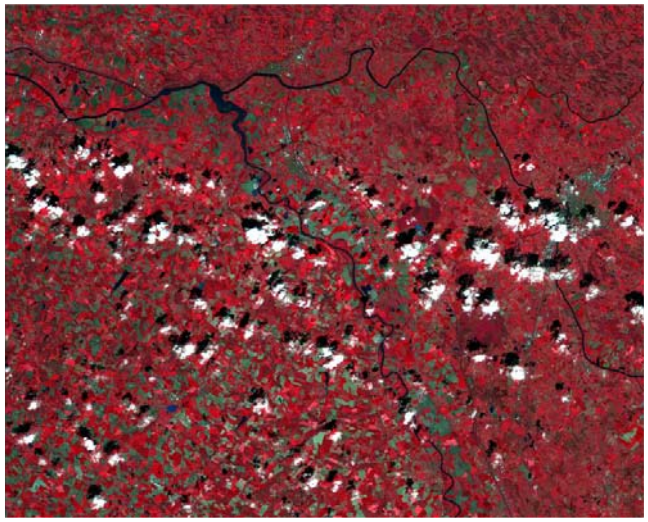
Cloud Confidence QI

SURFACE REFLECTANCE AT 10M

L1C Tile 31TCJ



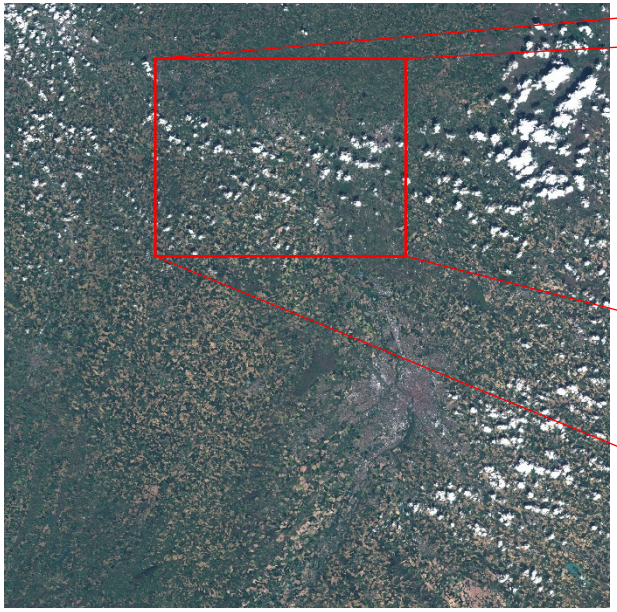
B04 – B03 – B02



B08 – B04 – B03

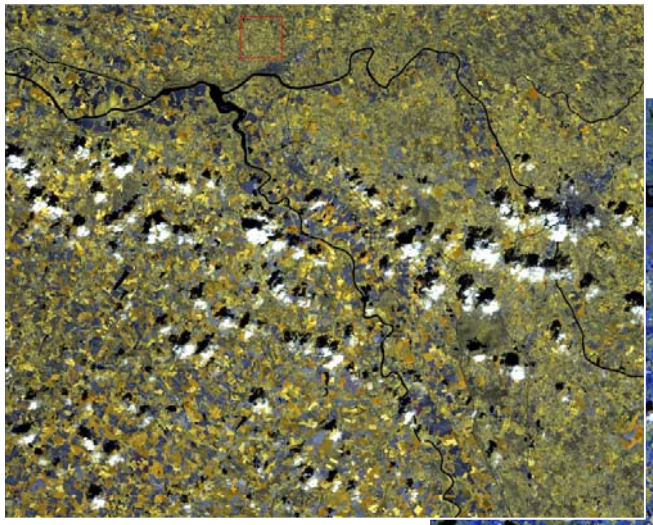
SURFACE REFLECTANCE AT 20M AND 60M

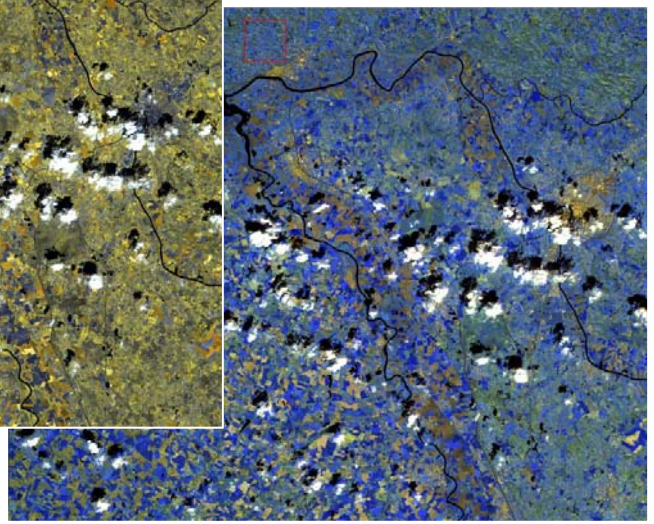
L1C Tile 31TCJ



B04 – B03 – B02

SWIR-NIR:
B12 – B11 – B8A



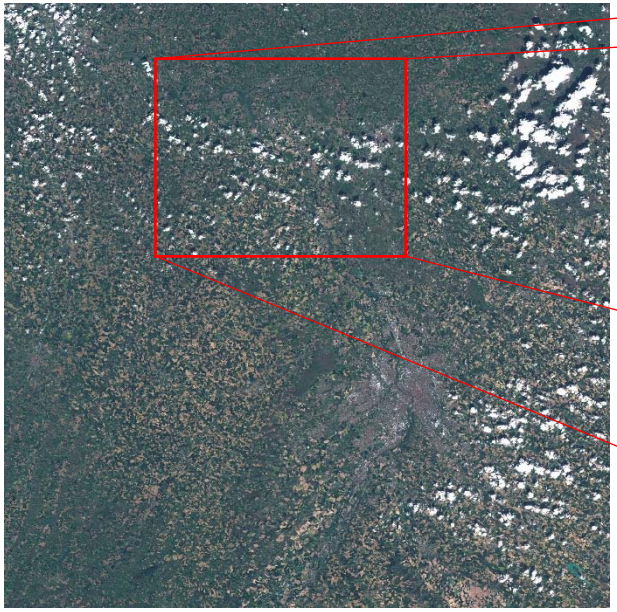


Red Edge:
B07 – B06 – B05

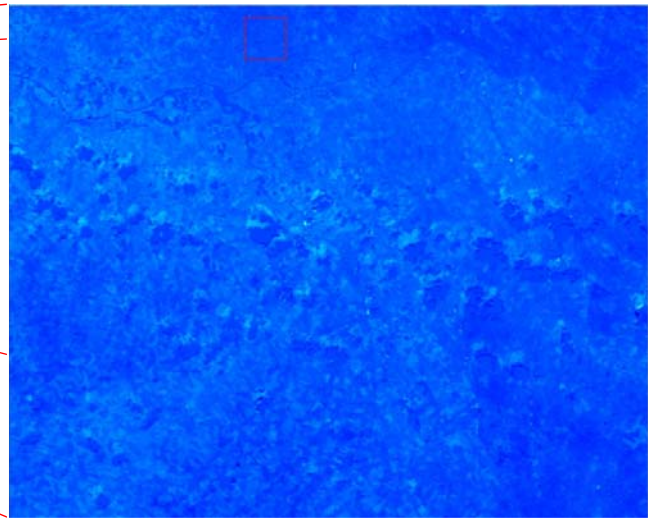
At 60m resolution the Band 1 and Band 9 are also available.

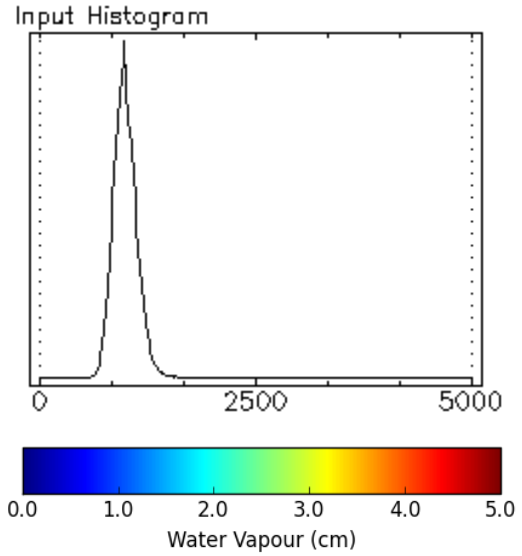
ATMOSPHERIC PARAMETERS AOT AND WV

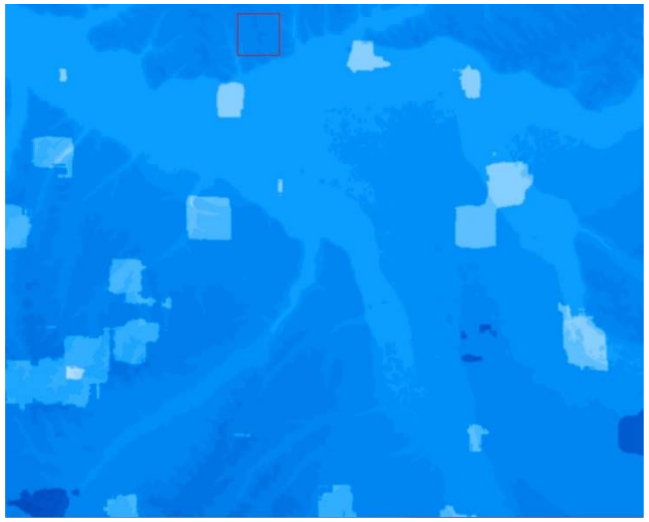
L1C Tile 31TCJ

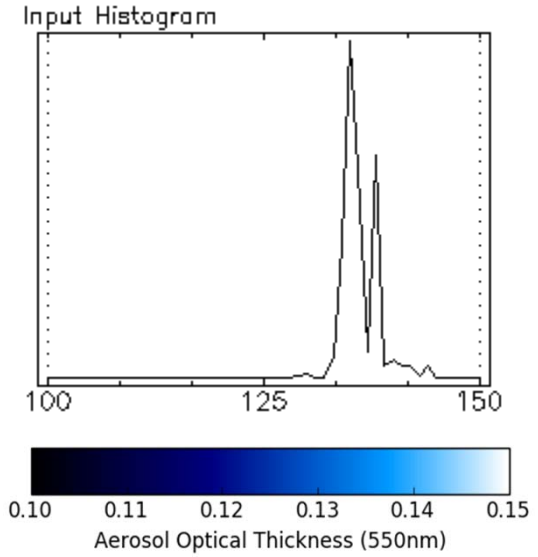


Water Vapour Column (cm)









Aerosol Optical Thickness

SEN2COR: BAND COMBINATIONS REQUIRED

- Cirrus correction:
  - B10 (1375 nm, 60m)
- AOT-retrieval:
  - B2 (490 nm, 10 m),

    B4 (665 nm, 10 m) & B12 (2190 nm, 20 m)
- WV-retrieval:
  - B8A (865nm, 20 m), B9 (945nm, 60m)
- SR-estimation, Terrain correction:
  - DEM used

GIPP	Default
Cirrus correction	Off
WV_Threshold	0.25
Visibility	Variable Visibility
WV correction	On
WV over water	Land average
Smooth WV map	100 m
Visibility	40 km
BRDF correction	No (select BRDF model)
BRDF lower bound	0.22
Adjacency range	1 km

SEN2COR RELATED LITERATURE

1. R. Richter, J. Louis, U. Müller-Wilm, [L2A-ATBD] Sentinel-2 Level-2A Products Algorithm Theoretical Basis Document, S2PAD-ATBD-0001, version 2.0, 2012
2. U. Müller-Wilm, [L2A-IODD] Sentinel-2 MSI – Level-2A Input Output Data Definition, issue 1.0, S2PAD-VEGA-IODD-0001, 2014

SEN2COR OUTLOOK

➔ Sen2Cor list of future evolutions:

- L2A products with JPEG2000 geo-information support
- Use ECMWF aerosol information in case of missing DDV-pixels
- Option for Rayleigh correction only (e.g. Antarctic)
- Avoid loss of information of spectral shape in case of negative reflectances (e.g. Water quality applications) -> Offset like for Landsat 8?
- Option to activate / deactivate terrain correction independently from DEM usage for CSC and AOT & WV estimation.

THANK YOU FOR YOUR ATTENTION!

Jérôme Louis
Vincent Debaecker
Uwe Müller-Wilm

Bringfried Pflug
Magdalena Main-Knorn
Jakub Bieniarz

jerome.louis@telespazio.com